REMARKS

Applicants initially wish to point out that they have amended the specification to correct an inconsistency with regard to the etch/dep ratio. Basis for the amendment may be found in originally filed claims 27 and 28.

In the first Office Action, claims 1-10, 12, 21-22 and 24-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,030,881 (Papasouliotis et al.) Papasouliotis et al. teach a method for filling high aspect ratio gaps using a high density plasma (HDP) deposition process in which the first step uses an etch/dep ratio less than one to quickly fill the gap, followed by a second step using an etch/dep ratio greater than one to widen the gap. These steps are repeated until the aspect ratio of the gap is reduced such that void-free gap filling is possible. The Examiner has acknowledged that Papasouliotis et al. do not teach a first etch/dep ratio which is higher than the second etch/dep ratio as claimed, but asserts that it would have been obvious for one skilled in the art to have done so "since Papsouliotis et al. disclose that such variables are result effective" and that "discovering their optimum value involves only routine skill in the art."

However, Papasouliotis et al. clearly teach a first step which uses an etch/dep ratio which is less than the etch/dep ratio used in the second step. This is in direct contrast to the claimed invention, which recites that the etch/dep ratio of the first step is greater than the etch/dep ratio of the second step. While Papsouliotis et al. disclose that the etch/dep ratio may be varied to optimize throughput and gap-fill capability (see col. 4, lines 44-46), there is no teaching or suggestion in Papasouliotis et al. that such variations should completely change the relationships of the first and second etch/dep ratios. In fact, Papasouliotis et al. teach that in order to maximize the gap-filling capability of the process, the first deposition step should have an etch/dep ratio of less than or equal to 0.25, and the second step should have an etch/dep ratio of greater than 50. See col. 4, lines 12-16 and 32-33. It clear that "optimizing" the etch dep ratios of Papasouliotis would not result in a reversal of this relationship and thus would not meet applicants' claims.

Nor do Papasouliotis et al. teach or suggest selecting a first gas flow and a first RF bias which achieves a first etch/dep ratio or a second gas flow and second RF bias which achieves a second etch/dep ratio as claimed. Nor do Papasouliotis et al. teach or suggest a step in which the first gas flow rate is lower than the second gas flow rate and/or a step in which the first RF bias is higher than the second RF bias as recited in claims 5-8. As taught in the present invention, the gas flow and RF bias are adjusted in order to control the etch/dep ratio. See the specification at page 6, paragraph 0020.

Nor do Papasouliotis et al. teach or suggest a process that results in the first layer of trench filling material having a substantially v-shaped upper surface profile as recited in claims 8, 21 and 24 and as shown in Fig.1B of the present invention. Rather, Papsouliotis et al. clearly teach a step in which cusps form as the gap is filled in the first step. See Fig. 5A.

Nor do Papasouliotis et al. teach a method in which the first etch/dep ratio is above about [0.3]? and the second etch/dep ratio is below about [0.3]? as recited in claims 27 and 28.

Finally, Papasouliotis et al. do not teach or suggest a method of forming first and second silicon dioxide layers for filling trenches in a semiconductor layer as recited in claim 29. Claims 1-10, 12, 21-22 and 24-29 are clearly patentable over Papasouliotis et al.

Claims 11, 13-20, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis et al. in view of U.S. Patent No. 5,872,058 (Van Cleemput et al.) The Examiner has cited Van Cleemput et al. for teaching a method of filling a high aspect ratio trench isolation structure without void formation by reducing the concentration of the inert gas used. With regard to claims 11 and 13, the Examiner asserts that Van Cleemput teach hydrogen as the inert gas, referring to col. 3, lines 32-37, and reasons that it would have been obvious to substitute hydrogen for the inert gas in Papasouliotis to meet applicants' claims.

However, there is no motivation for one skilled in the art to make the proposed substitution, and even if one were to do so, the claimed method would not result. Neither Papasouliotis et al. nor Van Cleemput teach or suggest a method in which the first etch/dep ratio is selected to be **higher** than the second etch/dep ratio for the purpose of reducing void

formation. Rather, Papasouliotis et al. achieve reduced void formation by utilizing a first etch/dep ratio which is **lower** than the second etch/dep ratio. Van Cleemput et al. achieve reduced void formation by reducing the concentration of the inert gas used (see abstract). And, while Van Cleemput et al. disclose hydrogen gas as one possible inert gas which may be used, the use of argon is clearly disclosed as being preferred. See col. 3, lines 28-33 and Table 1.

Nor do Papasouliotis et al. or Van Cleemput et al. teach or suggest the specific gas flow rate ranges recited in claims 15, 17, and 19. While Papsouliotis et al. teach gas flow rates which overlap with those of the present invention, there is no teaching or suggestion in Papasouliotis of providing the specific claimed flow rate ranges for the purpose of achieving the claimed relationship of first and second etch/dep ratios. Van Cleemput et al. teach gas flow rates which are outside applicants' claimed ranges. See Table 1.

Nor do Papasouliotis et al. or Van Cleemput et al. teach or suggest the first and second RF bias values recited in claims 16, 18, and 20. As pointed out above, the gas flow and RF bias are selected in order to control the etch/dep ratio. As neither Papasouliotis nor Van Cleemput teach or suggest the claimed etch/dep ratios, there is no motivation to modify their methods to provide the claimed RF bias and gas flow rates.

With regard to claim 23, the Examiner asserts that the trench of Van Cleemput is lined with a nitride layer prior to the deposition of the silicon oxide, referring to col. 3, lines 22-27. However, this provides no motivation for one skilled in the art to modify Papasouliotis et al. to include a nitride liner layer as claimed. Van Cleemput et al. merely makes a statement that passivation steps can provide protection layers such as silicon nitride for the wafer. There is no teaching or suggestion in Van Cleemput et al. of filling STI trenches including a nitride liner layer which is not substantially eroded during the filling of the trenches with first and second layers of trench filling materials as recited in claim 23. Even if one were to do so, the claims would not be met as neither Papasouliotis et al. or Van Cleemput et al. teach using a first etch/dep ratio which is higher than the second etch/dep ratio as recited in claim 23.

For all of the above reasons, applicants submit that claims 1-29 are clearly patentable over the cited references. Early notification of allowable subject matter is respectfully requested.

Respectfully submitted,

DINSMORE & SHOHL LLP

By Susan M. Luna
Susan M. Luna
Registration No. 38,769

One Dayton Centre
One South Main Street, Suite 1300
Dayton, Ohio 45402-2023
Telephone: (937) 449-6429
Facsimile: (937) 449-6405
SML/